& Tidewater Railroad. This is in Inyo County, Cal., and the air moving 600 miles southwest would pass over the Mojave Desert, then up and over the Sierra Madre, descending into the Great Valley of southern California. We thus have a record of the percentage of saturation of a great air stream at two points 600 miles distant, with an intervening range, the average elevation of which is 6,000 feet. Beginning Saturday, January 4, and lasting until January 8, there was a distinct decrease in the relative humidity and the percentage was much lower at the southern station. Low temperatures prevailed throughout this period, culminating January 6.

It would therefore seem that in future studies concerning the best methods of frost protection, special attention must be given to the moisture content of the air. This factor seems to play a controlling part in determining minimum temperatures. Not only this, but it is of great importance in connection with the maintenance of proper plant functions, especially in connection with transpiration.

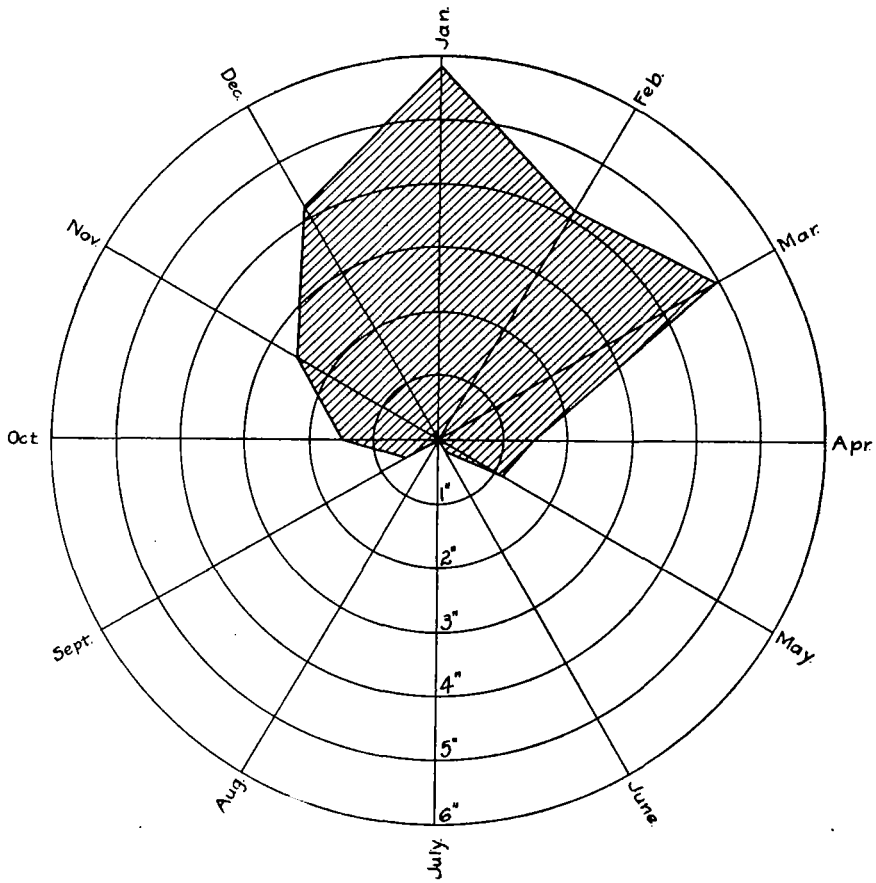

FIG. 1.—Mean monthly rainfall in inches at Berkeley, Cal.

THE RAINFALL OF BERKELEY, CAL.[1]

By WILLIAM GARDNER REED.

A rainfall record has been kept by the University of California as a cooperative station of the United States Weather Bureau since 1886, so that this record now covers a period of over 25 years. The university is located at Berkeley, which is 12 miles (19 kilometers) east-northeast from the Golden Gate and the Pacific Ocean, on the shoreward edge of a narrow coastal plain, which slopes gently from an altitude of 300 feet (90 meters) at the university campus to San Francisco Bay about 2 miles (3 kilometers) distant. East of the university the Berkeley Hills rise to an altitude of nearly 2,000 feet (600 meters) in 2 miles. The record, as shown in the table, is consistent with itself, and is of value as showing tendencies, if nothing more, although the exposure has been changed twice during the period and has at no time been ideal. Except for the years between 1892 and 1899 the exposure has been on a roof more or less protected by trees, but too far away to directly shelter the gage.

The table shows the monthly precipitation for the 25 years. This rainfall was recorded by the University and the results sent each month to the Weather Bureau Office in San Francisco, where they have been checked and corrected when necessary. It has been deemed advisable to use a rainfall year from July 1 to June 30 rather than the calendar year, as the rains at Berkeley are of the type known as subtropical, dry summers and winter rains under cyclonic control, so that the autumn rains should be grouped with those of the winter and spring of the following and not of the same calendar year. The mean monthly rainfall is shown graphically in figure 1.

July and August are months of little rain. Much of the precipitation in these months is from fog and occurs in amounts barely sufficient to be measured. The rainy season is generally preceded by light rains in September and October. But three Septembers and three Octobers have been rainless. September has an average rainfall of about half an inch (13 millimeters) and October about three times that amount. November may be said to mark the beginning of the season of heavy rainfall; the

[1] Published in full in the University of California Publications in Geography, vol. 1, No. 2, Berkeley, 1913.

average for the month is 2.54 inches (64.5 milimeters). December is one of the rainiest months, with a mean of 4.20 inches (106.7 millimeters). There is no December in which rain has not fallen. January has a heavier mean rainfall than any other month. The maximum precipitation for any single month in the 25 years is 15.99 inches (406.2 millimeters), January, 1911.

February shows a distinct falling off in the amount of precipitation, the average amount being smaller than that of January or March. This smaller amount is not wholly due to the fact that the month is shorter, but persists when the rainfall is corrected for the number of days in the month; it is, therefore, real as far as the Berkeley record for the 25 years is concerned. But if the three years in which the rainfall for February is abnormally low are eliminated, the mean amount is between that of January and that of March. Next to January, March has the heaviest mean monthly rainfall. The maximum for the month is 13.19 inches (335 millimeters) in 1899, which was not exceeded in any month except January, 1911.

The marked rainy season ends rather abruptly with March, although rains are not unusual in April and May. The mean rainfall for each of these months is between an inch (25 millimeters) and an inch and a half (38 millimeters). In the two driest years, 1897–98 and 1911–12, the rainfall for May was above the mean. June has the general characteristics of a summer month on the Pacific coast; in 11 of the 25 years the rainfall for June was less than 0.01 inch (0.2 millimeter). The average for the month is less than a quarter of an inch (6.4 millimeters).

The mean precipitation for the rainfall year, July to July, is 26.60 inches (675.6 millimeters), but the amounts recorded for the individual years vary greatly from this mean. The precipitation for each of the 25 rainfall years is shown by figure 2. The most striking characteristics of the seasonal rainfall are the occurrence of wide departures from the mean, from 54 per cent in 1897–98 to 173 per cent in 1889–90, and the small departure in many of the years, less than 15 per cent in 14 of the 25 years. If the curve of rainfall amounts by seasonal years is smoothed so that too much emphasis may not be given to individual years, the general tendencies of the rainfall become more apparent, and progressive changes or periods in the rainfall may appear. But all smoothed curves must be regarded as more or less biased by the method of smoothing, even when a formula is used. Figure 3 is the curve of seasonal precipitation at Berkeley smooted by Blanchard's formula,

$$\frac{A+4B+6C+4D+E}{16}=C',$$

where A, B, C, D, and E are a group of five successive years and C′ is the progressive average for the middle year of the group. C′ may be used in place of the actual

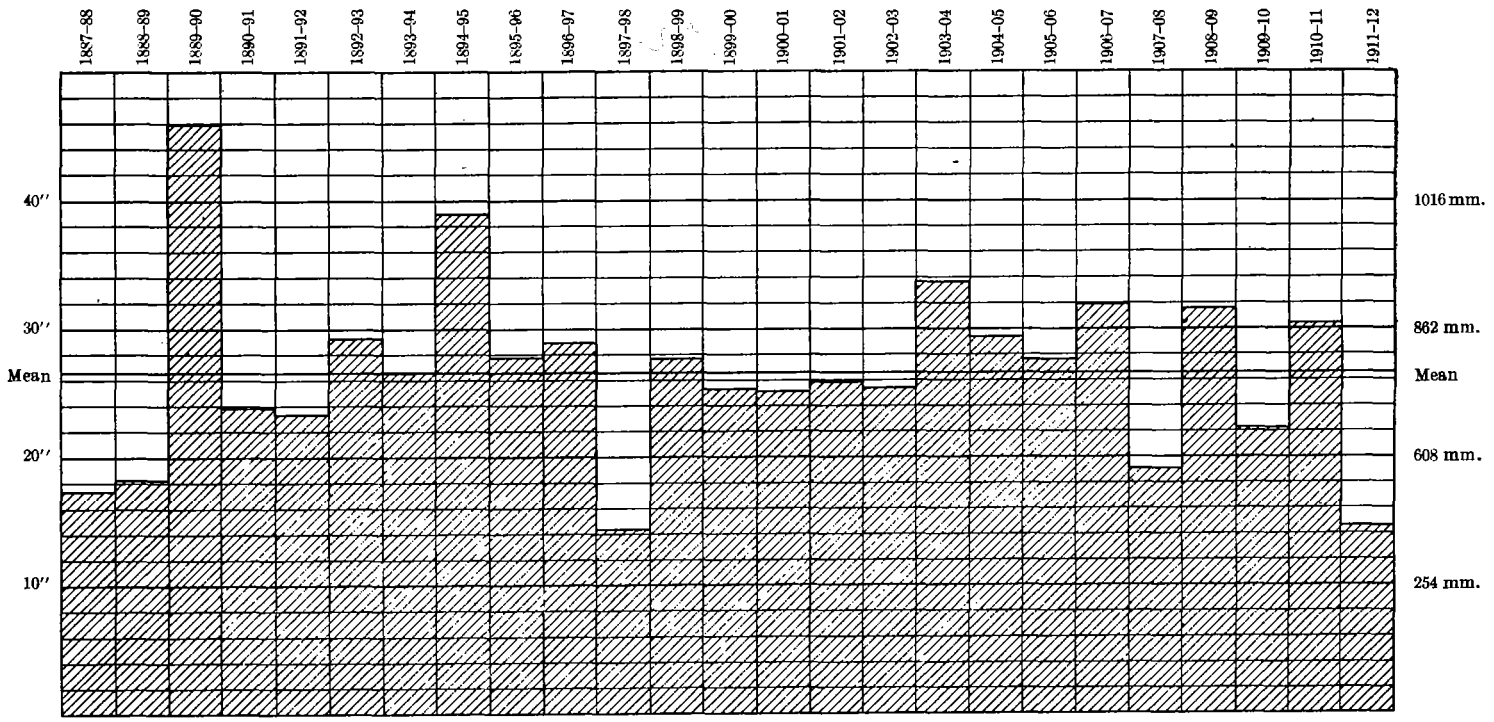

FIG. 2.—Precipitation at Berkeley, Cal., by rainfall, years ending July 1, from 1887 to 1912, inclusive.

amount for the middle year to eliminate accidental conditions which affect a single year only.[1] This curve shows no progressive change, but does seem to indicate an oscillation with a period of about 10 years from crest to crest, although the record is not long enough to make this certain.

The 25-year rainfall record for Berkeley shows the subtropical régime of precipitation. The greater part of the rains occur between the beginning of November and the end of March, but rains are not uncommon except in July and August, which months are usually dry.

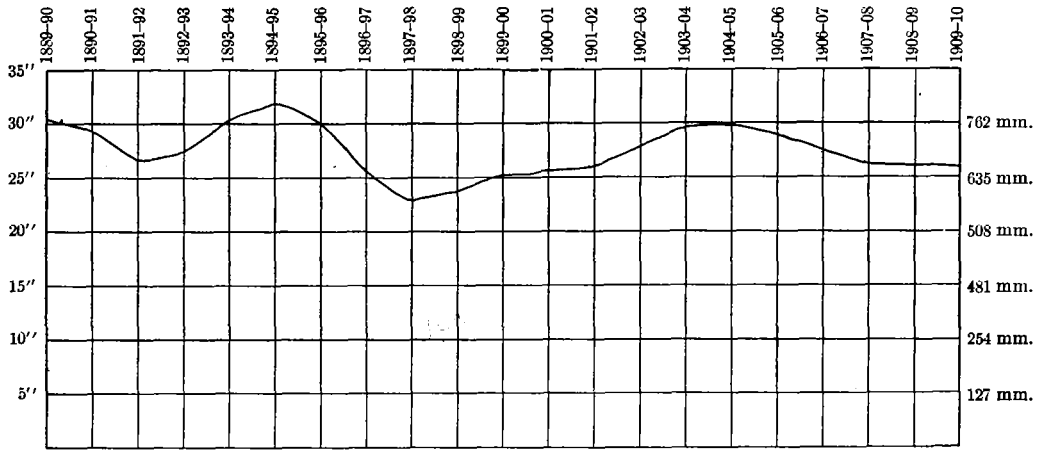

FIG. 3.—Smoothed curve showing mean annual precipitation at Berkeley, Cal.

Monthly and seasonal rainfall of Berkeley, Cal.

Season.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Seasonal.	Per cent of seasonal mean.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
1887–88	0.01	0	0.40	0	0.76	2.94	5.84	1.92	4.50	0.20	0.42	0.50	17.49	66
1888–89	T.	0	0.59	0.02	2.71	3.79	0.78	0.54	7.58	0.72	1.50	0.06	18.29	69
1889–90	0	0	0	5.80	2.39	12.59	11.16	5.70	4.74	2.18	1.44	T.	46.00	173
1890–91	0	T.	0.25	0	0	3.32	1.13	10.68	3.17	3.42	1.61	0.38	23.96	90
1891–92	0.44	0	0.74	0.18	1.01	6.22	2.34	4.20	3.60	1.68	2.97	0	23.38	88
1892–93	0.01	0	0.07	1.99	5.35	6.64	3.90	3.28	6.19	1.62	0.26	0	29.31	110
1893–94	0	0	0.38	0.52	5.22	2.62	9.54	3.77	0.91	0.57	2.01	1.11	26.65	100
1894–95	0	0	1.61	3.29	1.35	12.63	10.88	3.25	2.64	2.30	1.06	0	39.01	147
1895–96	0.04	0	1.28	0.07	1.78	2.20	11.40	0.36	2.93	6.72	0.94	0	27.72	104
1896–97	T.	0.90	0.76	1.91	5.15	4.92	3.71	4.68	5.97	0.44	0.20	0.30	28.94	109
1897–98	0	0	0.20	2.48	1.58	2.71	1.54	3.28	0.31	0.19	1.87	0.24	14.40	54
1898–99	0	0.04	0.93	1.88	0.97	1.22	5.90	0.22	13.19	1.56	1.70	0.05	27.66	104
1899–1900	0	T.	0	5.26	5.85	3.46	4.18	1.02	3.00	1.58	0.91	0.08	25.34	96
1900–1901	0	0.02	0.05	1.41	5.04	1.83	5.86	5.91	0.91	3.06	1.02	0	25.11	94
1901–2	0	0	1.30	0.68	3.16	1.48	1.36	10.47	4.17	1.55	1.69	0	25.86	97
1902–3	0	T.	0	2.35	3.21	3.69	5.17	2.05	7.81	1.11	0.02	T.	25.41	96
1903–4	0	0	0	0.50	5.89	2.19	1.40	10.45	11.04	2.10	0.02	T.	33.59	126
1904–5	0	0.07	4.44	3.39	2.23	2.03	5.58	2.56	4.25	1.37	3.43	0	29.35	110
1905–6	0	0	0	0	1.46	2.22	6.92	3.96	9.05	0.74	2.56	0.64	27.55	104
1906–7	0	0.04	0.17	T.	1.64	7.24	5.02	5.36	10.76	0.36	0.04	1.24	31.87	120
1907–8	0	0	0.06	1.54	0.08	4.84	5.44	4.35	1.37	0.30	1.17	0.01	19.16	72
1908–9	0	0	0.09	0.98	1.83	2.62	13.11	9.26	3.64	0.02	0	0	31.55	119
1909–10	0	0	0.78	1.34	3.43	7.24	3.38	1.85	3.82	0.41	0.01	0.02	22.28	84
1910–11	0	0	0.06	0.60	0.87	1.80	15.99	4.05	5.17	1.56	0.27	0.04	30.41	114
1911–12	T.	0	T.	0.73	0.46	2.51	3.65	0.54	2.96	1.47	1.56	0.85	14.73	55
Means	0.02	0.04	0.57	1.48	2.54	4.20	5.81	4.15	4.95	1.49	1.15	0.22	26.60	100

[1] See Beals, E. A.: Variations in Rainfall, Mo. Wea. Rev., vol. 39 (1911), pp. 1448–1452